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EXAMINER	
KENNEDY, JENNIFER M	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/053,572	Applicant(s) OHNUMA, HIDETO	
	Examiner Jennifer M. Kennedy	Art Unit 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

Claim 21 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation that the chemical oxide is formed using a liquid chemical while 21 recites the limitation of forming the chemical oxide film by an ozone treatment through ultraviolet irradiation in an atmosphere containing oxygen. The examiner notes that an ozone treatment is not a liquid chemical.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (U.S. Patent Appl 2002/0098635) in view of Ohtani et al. (U.S. Patent No. 5,966,596).

In re claim 1, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), crystallizing the semiconductor film comprising silicon (see [0117]); forming an oxide film (33) on a surface of the

crystallized semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]) and forming at least one channel region comprising a portion of the doped semiconductor film (see [0121]-[0124]).

Zhang et al. does not disclose the method of forming a chemical oxide film. Ohtani et al. discloses a method of forming a chemical oxide film using a liquid chemical (see column 2, lines 44-46, and column 6, lines 55-64). The examiner notes that Applicant has not taught that the method of forming the oxide film by a chemical oxide method by using a liquid chemical is critical. Rather, Applicant's have taught that the oxide film may be formed by alternative method such as UV radiation in an atmosphere containing oxygen (see for instance [0089]).

The examiner also notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide

layer in TFT fabrication and teaches that the oxide layer improves the surface characteristics of the underlying silicon film (see Ohtani et al. column 2, lines 39-46).

In re claim 4, Zhang et al. teaches the method wherein the semiconductor film comprising silicon is an amorphous semiconductor film comprising silicon (31, see [0117]).

In re claims 7, 10, and 22, Zhang et al does not disclose the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film. Ohtani et al. also discloses the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film (see column 7, lines 20-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a catalytic element of Ni to the amorphous silicon film of Zhang et al. in order to accelerate the crystallization of the amorphous silicon film, thereby increasing throughput.

In re claim 13, Zhang et al. teaches the method wherein the material including hydrogen is used as the ion source for the impurity ions (see [0118]-[0119]).

In re claim 16, Zhang et al. teaches the method wherein the doping step allows channel doping to be implemented (see [0124]). The examiner notes that the doping step of ([0118]-[0119]) creates a doped silicon layer 34, which is subsequently doped and renumbered 35 and 36 (see Figure 8A-8D). The doped silicon layer is then etched

into island-like semiconductor layers 11 and 12 (see [0121]), of which a portion of each is the channel region.

In re claims 19, 20, and 21, Ohtani et al. discloses the chemical oxide film is formed by treatment with ozone water, hydrogen peroxide or by ozone treatment through ultraviolet irradiation in an atmosphere containing oxygen (see column 2, lines 44-46).

In re claim 24, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses that the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 37, the combined Zhang et al. and Ohtani et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Ohtani et al. column 2, lines 39-41).

In re claim 2, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide (33) film which protects the semiconductor film from being etched by a subsequent doping step (33) on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]) and

forming at least one channel region comprising a portion of the doped semiconductor film (see [0121]-[0124]).

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see [0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with oxygen. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with oxygen. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the

substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds with oxygen as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 5, Zhang et al. teaches the method wherein the semiconductor film comprising silicon is an amorphous semiconductor film comprising silicon (31, see [0117]).

In re claims 8 and 11, Zhang et al does not disclose the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film. Ohtani et al. also discloses the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film (see column 7, lines 20-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a catalytic element of Ni to the amorphous silicon film of Zhang et al. in order to accelerate the crystallization of the amorphous silicon film, thereby increasing throughput.

In re claim 14, Zhang et al. teaches the method wherein the material including hydrogen is used as the ion source for the impurity ions (see [0118]-[0119]).

In re claim 17, Zhang et al. teaches the method wherein the doping step allows channel doping to be implemented (see [0124]). The examiner notes that the doping step of ([0118-0119]) creates a doped silicon layer 34, which is subsequently doped and renumbered 35 and 36 (see Figure 8A-8D). The doped silicon layer is then etched into island-like semiconductor layers 11 and 12 (see [0121]), of which a portion of each is the channel region.

In re claim 25, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses

the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 3, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide film (33) which protects the semiconductor film from being etched by a subsequent doping step (33) on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]) and forming at least one channel region comprising a portion of the doped semiconductor film (see [0121]-[0124]).

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see [0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy

higher than that of Si-H bonds. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen which is an with an element to be bonded with bonding energy higher than that of Si-H bonds (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer ,33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the

time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 6, Zhang et al. teaches the method wherein the semiconductor film comprising silicon is an amorphous semiconductor film comprising silicon (31, see [0117]).

In re claims 9 and 12, Zhang et al does not disclose the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film. Ohtani et al. also discloses the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film (see column 7, lines 20-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a catalytic element of

Ni to the amorphous silicon film of Zhang et al. in order to accelerate the crystallization of the amorphous silicon film, thereby increasing throughput.

In re claim 15, Zhang et al. teaches the method wherein the material including hydrogen is used as the ion source for the impurity ions (see [0118]-[0119]).

In re claim 18, Zhang et al. teaches the method wherein the doping step allows channel doping to be implemented (see [0124]). The examiner notes that the doping step of [0118-0119]) creates a doped silicon layer 34, which is subsequently doped and renumbered 35 and 36 (see Figure 8A-8D). The doped silicon layer is then etched into island-like semiconductor layers 11 and 12 (see [0121]), of which a portion of each is the channel region.

In re claim 26, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 23, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31), specifically amorphous silicon, over an insulating substrate (1), crystallizing the semiconductor film comprising silicon (see [0117]); forming an oxide

film (33) on a surface of the crystallized semiconductor film comprising silicon, and doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]), patterning the semiconductor film to form at least on active layer after doping (see [0121]), forming a gate insulating film (5) over the active layer after patterning the semiconductor film and forming a gate electrode (6) over the semiconductor film with the gate insulating film interposed therebetween.

Zhang et al. does not disclose the method of forming a chemical oxide film. Ohtani et al. discloses a method of forming a chemical oxide film using a liquid chemical (see column 2, lines 44-46, and column 6, lines 55-64). The examiner notes that Applicant has not taught that the method of forming the oxide film by a chemical oxide method by using a liquid chemical is critical. Rather, Applicant's have taught that the oxide film may be formed by alternative method such as UV radiation in an atmosphere containing oxygen (see for instance [0089]).

The examiner also notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide

layer in TFT fabrication and teaches that the oxide layer improves the surface characteristics of the underlying silicon film (see Ohtani et al. column 2, lines 39-46).

In re claim 27, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 38, the combined Zhang et al. and Ohtani et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Ohtani et al. column 2, lines 39-41).

In re claim 28, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31), specifically amorphous silicon, over an insulating substrate (1), crystallizing the semiconductor film comprising silicon (see [0117]); forming an oxide film (33) on a surface of the crystallized semiconductor film comprising silicon, and doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118])-[0119]), forming a gate insulating film (5) over the semiconductor film after doping and forming a gate electrode (6) over the gate insulating film.

Zhang et al. does not disclose the method of forming a chemical oxide film. Ohtani et al. discloses a method of forming a chemical oxide film using a liquid chemical

(see column 2, lines 44-46, and column 6, lines 55-64). The examiner notes that Applicant has not taught that the method of forming the oxide film by a chemical oxide method by using a liquid chemical is critical. Rather, Applicant's have taught that the oxide film may be formed by alternative method such as UV radiation in an atmosphere containing oxygen (see for instance [0089]).

The examiner also notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide layer in TFT fabrication and teaches that the oxide layer improves the surface characteristics of the underlying silicon film (see Ohtani et al. column 2, lines 39-46).

In re claim 31, Zhang et al. further discloses the method wherein in the doping step a material gas is at least one selected from the group consisting of diborane, phosphine, arsine and those obtained through dilution thereof with hydrogen (see [0118]-[0119]).

In re claim 34, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of

personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 39, the combined Zhang et al. and Ohtani et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Ohtani et al. column 2, lines 39-41).

In re claim 29, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide film (33) which protects the semiconductor film from being etched by a subsequent doping step on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions after forming the oxide film (see [0118]-[0119]), forming a gate insulating film (5) over the semiconductor film after doping, and forming a gate electrode (6) over the gate insulating film.

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see [0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching

of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with oxygen. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with oxygen. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide

layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds with oxygen as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 32, Zhang et al. further discloses the method wherein in the doping step a material gas is at least one selected from the group consisting of diborane, phosphine, arsine and those obtained through dilution thereof with hydrogen (see [0118]-[0119]).

In re claim 35, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was

made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

In re claim 30, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), forming an oxide film (33) which protects the semiconductor film from being etched by a subsequent doping step on a surface of the semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions after forming the oxide film (see [0118]-[0119]), forming a gate insulating film (5) over the semiconductor film after doping, and forming a gate electrode (6) over the gate insulating film.

The examiner notes that the protective oxide layer, 33, of Zhang et al. is formed directly prior to the doping process of Zhang et al. and therefore is formed to protect during the doping process. Further, Zhang et al. teaches that the acceleration voltage of the dopant is adjusted in accordance with the thickness of the protective oxide (see [0118]). The protective oxide layer of Zhang et al. will to some degree prevent etching of the surface of the semiconductor film when compared with a semiconductor film without the protective oxide formed thereon.

Zhang et al. does not disclose the method of terminating the dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds. Ohtani et al. discloses a method of forming a chemical oxide film by ultraviolet radiation within an oxygen ambient or immersing the substrate in

ozone water or hydrogen peroxide water (see column 2, lines 39-46 and column 6, lines 55-64).

Ohtani et al. does not explicitly state that the pretreatment terminates dangling bonds on a surface of the semiconductor film with an element to be bonded with bonding energy higher than that of Si-H bonds. However, as explained in the applicant's specification the termination of bonds in the present application occur with oxygen which is an element to be bonded with bonding energy higher than that of Si-H bonds (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the same conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

The examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer, 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer, 33, in the absence of a particular suggestion by Zhang et

al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64) that terminates dangling bonds with an element to be bonded with bonding energy higher than that of Si-H bonds as explained above. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

In re claim 33, Zhang et al. further discloses the method wherein in the doping step a material gas is at least one selected from the group consisting of diborane, phosphine, arsine and those obtained through dilution thereof with hydrogen (see [0118]-[0119]).

In re claim 36, Zhang et al does not disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

Claims 1, 4, 13, 16, 20, 23, 28, 31, 37, 38, and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (U.S. Patent Appl 2002/0098635) in view of Wright et al. (U.S. Patent No. 6,261,936).

In re claim 1, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31) over an insulating substrate (1), crystallizing the semiconductor film comprising silicon (see [0117]); forming an oxide film (33) on a surface of the crystallized semiconductor film comprising silicon, doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]) and forming at least one channel region comprising a portion of the doped semiconductor film (see [0121]-[0124]).

Zhang et al. does not disclose the method of forming a chemical oxide film. Wright et al. discloses a method of forming a chemical oxide film using a liquid chemical (see column 5, line 4-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Wright et al., because as Wright et al. teaches the method allows for control of thickness of the screen oxide layer.

In re claim 4, Zhang et al. teaches the method wherein the semiconductor film comprising silicon is an amorphous semiconductor film comprising silicon (31, see [0117]).

In re claim 13, Zhang et al. teaches the method wherein the material including hydrogen is used as the ion source for the impurity ions (see [0118]-[0119]).

In re claim 16, Zhang et al. teaches the method wherein the doping step allows channel doping to be implemented (see [0124]). The examiner notes that the doping step of ([0118]-[0119]) creates a doped silicon layer 34, which is subsequently doped and renumbered 35 and 36 (see Figure 8A-8D). The doped silicon layer is then etched into island-like semiconductor layers 11 and 12 (see [0121]), of which a portion of each is the channel region.

In re claim 20, Wright et al. discloses the chemical oxide film is formed by hydrogen peroxide (see column 5, lines 5-65).

In re claim 37, the combined Zhang et al. and Wright et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Wright et al. column 5, lines 5-65).

In re claim 23, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31), specifically amorphous silicon, over an insulating substrate (1), crystallizing the semiconductor film comprising silicon (see [0117]); forming an oxide film (33) on a surface of the crystallized semiconductor film comprising silicon, and doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118]-[0119]), patterning the semiconductor film to form at least on active layer after doping (see [0121]), forming a gate insulating film (5) over the active layer after patterning the semiconductor film and forming a gate electrode (6) over the semiconductor film with the gate insulating film interposed therebetween.

Zhang et al. does not disclose the method of forming a chemical oxide film. Wright et al. discloses a method of forming a chemical oxide film using a liquid chemical

(see column 5, line 4-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Wright et al., because as Wright et al. teaches the method allows for control of thickness of the screen oxide layer.

In re claim 38, the combined Zhang et al. and Wright et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Wright et al. column 5, lines 5-65).

In re claim 28, Zhang et al. discloses the method of forming a semiconductor film comprising silicon (31), specifically amorphous silicon, over an insulating substrate (1), crystallizing the semiconductor film comprising silicon (see [0117]); forming an oxide film (33) on a surface of the crystallized semiconductor film comprising silicon, and doping the semiconductor film comprising silicon with impurity ions through the oxide film (see [0118])-[0119]), forming a gate insulating film (5) over the semiconductor film after doping and forming a gate electrode (6) over the gate insulating film.

Zhang et al. does not disclose the method of forming a chemical oxide film. Wright et al. discloses a method of forming a chemical oxide film using a liquid chemical (see column 5, line 4-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Wright et al., because as Wright et al. teaches the method allows for control of thickness of the screen oxide layer.

In re claim 31, Zhang et al. further discloses the method wherein in the doping step a material gas is at least one selected from the group consisting of diborane, phosphine, arsine and those obtained through dilution thereof with hydrogen (see [0118]-[0119]).

In re claim 39, the combined Zhang et al. and Wright et al. disclose the method wherein the chemical oxide film is 5 nm or less (see Wright et al. column 5, lines 5-65).

Claims 7, 10, 19, 21, 22, 24, 27, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (U.S. Patent Appl 2002/0098635) in view of Wright et al. (U.S. Patent No. 6,261,936), and further in view of Ohtani et al. (U.S. Patent No. 5,966,596)

In re claims 7, 10, and 22, neither Zhang et al nor Wright et al. disclose the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film. Ohtani et al. also discloses the method wherein a catalytic element of Ni, having the effect of accelerating crystallization is applied to the amorphous semiconductor film, and a heat treatment is conducted to form a crystalline semiconductor film (see column 7, lines 20-50). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a catalytic element of

Ni to the amorphous silicon film of Zhang et al. in order to accelerate the crystallization of the amorphous silicon film, thereby increasing throughput.

In re claim 19 and 21 neither Zhang et al. nor Wright disclose the method the chemical oxide film is formed by treatment with ozone water or by ozone treatment through ultraviolet irradiation in an atmosphere containing oxygen. Ohtani et al. discloses the chemical oxide film is formed by treatment with ozone water, hydrogen peroxide or by ozone treatment through ultraviolet irradiation in an atmosphere containing oxygen (see column 2, lines 44-46). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the chemical oxide by the method of Ohtani et al. because as Ohtani et al. teaches the method of forming a chemical oxide by a hydrogen peroxide solution, ozone water or by ozone treatment through ultraviolet irradiation in an atmosphere containing oxygen are interchangeable in the art to form a chemical oxide on a surface of silicon. Further, Applicants have not taught that the method of forming the oxide film is critical. Rather, Applicant's have taught that the oxide film may be formed by a hydrogen peroxide solution, ozone water or an alternative method such as UV radiation in an atmosphere containing oxygen (see for instance [0089]). The substitution of one known technique for another may be obvious even if the prior art does not expressly suggest the substitution. *Ex parte Novak* 16 USPQ 2d 2041 (BPAI 1989); *In re Mostovych* 144 USPQ 38 (CCPA 1964) ; *In re Leshin* 125 USPQ 416 CCPA 1960) ; *Graver Tank & Manufacturing Co. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

In re claim 24, 27 and 34, neither Zhang et al nor Wright et al. disclose the method wherein the semiconductor device is at least one device selected from the group consisting of personal computer, video camera, a mobile computer, a goggle type display device, a DVD player, a CD player, a portable telephone, a projector. Ohtani et al. also discloses that the semiconductor device could be a mobile computer (see column 1, lines 24-25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the TFT of Zhang et al. in a mobile computer since TFTs allow for a display with high information content at a high speed.

Response to Arguments

Applicant's arguments filed June 6, 2005 have been fully considered but they are not persuasive.

The examiner notes that the newly added limitations have been addressed in the rejection above. Specifically, in the combined rejection of Zhang et al. and Ohtani et al., Zhang et al. is relied upon for showing that the oxide is formed on the crystallized silicon.

In view of the above amendment Applicant again argues that the examiners rationale for combining, noting that the chemical oxide film of Ohtani et al. is formed before crystallization, rather than after crystallization. The examiner notes that Zhang et al. has been relied upon to show that the oxide is formed prior to crystallizing. Ohtani et al. is relied upon to show the method of forming a chemical oxide film.

The examiner maintains that it would have been obvious to form the oxide film of Zhang et al. by the method of Ohtani et al. since the examiner notes that Zhang et al. does not disclose a particular method for forming the oxide layer 33, and therefore the particular method used to form the oxide layer lacks criticality in the invention of Zhang et al. One of ordinary skill in the art at the time the invention was made would have recognized that any known method could be used to form the oxide layer 33 in the absence of a particular suggestion by Zhang et al. Ohtani et al. discloses a method of forming a chemical oxide film (see column 2, lines 44-46, and column 6, lines 55-64). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the oxide layer of Zhang et al. by the method of Ohtani et al., since the method of forming an oxide layer lacks criticality in the invention of Zhang et al., and since the method of Ohtani is a known method of forming an oxide that improves the surface characteristics of the underlying film (see Ohtani et al. column 2, lines 39-46).

The selection of a known material or method based on its suitability for its intended use supported a prima facie obviousness determination in Sinclair & Carroll Co. v. Interchemical Corp., 325 U.S. 327, 65 USPQ 297 (1945) (Claims to a printing ink comprising a solvent having the vapor pressure characteristics of butyl carbitol so that the ink would not dry at room temperature but would dry quickly upon heating were held invalid over a reference teaching a printing ink made with a different solvent that was nonvolatile at room temperature but highly volatile when heated in view of an article which taught the desired boiling point and vapor pressure characteristics of a solvent for

printing inks and a catalog teaching the boiling point and vapor pressure characteristics of butyl carbitol. "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig-saw puzzle." 325 U.S. at 335, 65 USPQ at 301.).

See also In re Leshin, 227 F.2d 197, 125 USPQ 416 (CCPA 1960) (selection of a known plastic to make a container of a type made of plastics prior to the invention was held to be obvious); Ryco, Inc. v. Ag-Bag Corp., 857 F.2d 1418, 8 USPQ2d 1323 (Fed. Cir. 1988) (Claimed agricultural bagging machine, which differed from a prior art machine only in that the brake means were hydraulically operated rather than mechanically operated, was held to be obvious over the prior art machine in view of references which disclosed hydraulic brakes for performing the same function, albeit in a different environment.).

Applicant argues that the chemical oxide film of the present application prevents the silicon semiconductor film from being etched. The examiner notes that Zhang et al. teaches forming an oxide film that prevents the underlying silicon from being etched during the ion doping, and the oxide film of Ohtani et al. when applied to Zhang et al. would provide this protection as well. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicant admits that Ohtani et al. disclose that the thin oxide film can be formed by ultraviolet radiation within an oxygen ambient or immersing the substrate in ozone

ater or hydrogen peroxide, thus forming a thin oxide film, but argues that does not teach or suggest "chemical structures". While, Applicant has not claimed any "chemical structures", the examiner believes that Applicant is referring to the claim limitations that refer to terminating the dangling bonds. As explained in the applicant's specification the termination of bonds in the present application occur with oxygen which is an element to be bonded with bonding energy higher than that of Si-H bonds (see specification, page 17, line 13 through page 18, line 5). The examiner points out that the amorphous silicon of Ohtani et al. is oxidized by illuminating the substrate with a UV light in an oxygen ambient to form the chemical oxide. The examiner notes that UV light increases the reactivity of the oxygen atoms, and it is clear by the formation of the oxide that the oxygen molecules react on the surface of the substrate, thus terminating the dangling bonds on the surface of the semiconductor film with oxygen. Finally the examiner notes that Ohtani et al. discloses the *same* conditions and steps as that of the applicant's disclosure with respect to forming the oxide. Applicant has not provided any required conditions for forming the oxide that would terminate the dangling bonds other than the presence of oxygen.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., terminating the dangling bonds only on a portion of the surface of the silicon layer) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

It is noted that Applicants do not argue that the method of Ohtani et al. does not terminate the dangling bonds, rather Applicant only argues that Ohtani et al. does not show the "chemical structure".

In re independent claims 2, 3, 29, and 30 and their dependent claims, Applicant again argues that the examiners rationale for combining stating that "merely asserting that the method of forming an oxide layer lacks criticality in the invention of Zhang et al., or that Ohtani is a known method of forming and oxide that improves the surface characteristics of the underlying film is not sufficient to instruct one of ordinary skill in the art to use the Ohtani method to form the protective film 33 in Zhang." The examiner disagrees and notes that Ohtani et al. teaches an advantage of forming the oxide layer by this method which is to improve the surface characteristics of the underlying film. This teaching, and the resulting advantage, would instruct one of ordinary skill in the art to form the oxide layer of Zhang et al. by the method of Ohtani et al. Further, as pointed out in a previous response, the improved surface characteristics allow for a nickel catalyst to be used In Ohtani et al., which accelerates the crystallization of the amorphous film. The combination of Zhang et al. and Ohtani et al. have also been relied upon to show the limitations of a metal catalyst for crystallization of the amorphous silicon.

The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See Ex pa/e Oô/aya, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (571) 272-1672. The examiner can normally be reached on Mon.-Fri. 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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jmk

Jennifer M. Kennedy
JENNIFER KENNEDY
PRIMARY EXAMINER